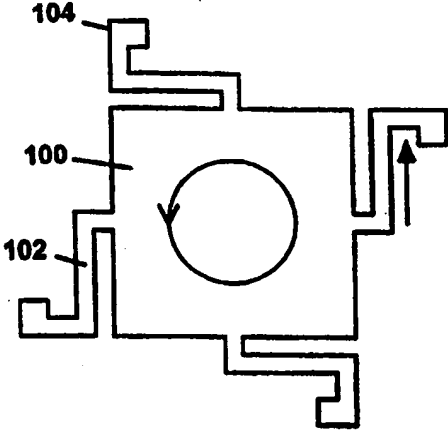


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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G02B 26/02	A3	(11) International Publication Number: WO 99/52006 (43) International Publication Date: 14 October 1999 (14.10.99)
(21) International Application Number: PCT/US99/07271 (22) International Filing Date: 1 April 1999 (01.04.99) (30) Priority Data: 09/056,975 8 April 1998 (08.04.98) US (63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application US 09/056,975 (CON) Filed on 8 April 1998 (08.04.98) (71) Applicant (for all designated States except US): ETALON, INC. [US/US]; Suite 501, 354 Congress Street, Boston, MA 02110-1237 (US). (72) Inventor; and (75) Inventor/Applicant (for US only): MILES, Mark, W. [US/US]; Suite 501, 354 Congress Street, Boston, MA 02110-1237 (US). (74) Agent: FEIGENBAUM, David, L.; Fish & Richardson P.C., 225 Franklin Street, Boston, MA 02110-2804 (US).		(81) Designated States: KR, US. Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 29 December 1999 (29.12.99)
(54) Title: INTERFEROMETRIC MODULATION OF RADIATION (57) Abstract <p>The invention features an interferometric modulator comprising a cavity defined by two walls. At least two arms connect the two walls to permit motion of the walls relative to each other. The two arms are configured and attached to a first one of the walls in a manner that enables mechanical stress in the first wall to be relieved by motion of the first wall essentially within the plane of the first wall.</p> 		

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/07271

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G02B26/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G02B B81C G09F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 95 30924 A (ETALON INC ;MILES MARK W (US)) 16 November 1995 (1995-11-16) page 33, line 20 -page 34, line 15; figure 28 --- -/--	1-8,10, 11,15, 23,24 14

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

12 August 1999

Date of mailing of the international search report

10. 11. 1999

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SCHEU, M

INTERNATIONAL SEARCH REPORT

Internat	Application No
PCT/US 99/07271	

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>ARATANI K ET AL: "PROCESS AND DESIGN CONSIDERATIONS FOR SURFACE MICROMACHINED BEAMS FOR A TUNEABLE INTERFEROMETER ARRAY IN SILICON"</p> <p>PROCEEDINGS OF THE WORKSHOP ON MICRO ELECTRO MECHANICAL SYSTEMS (ME, FORT LAUDERDALE, FEB. 7 - 10, 1993, no. WORKSHOP 6, 7 February 1993 (1993-02-07), pages 230-235, XP000366885</p> <p>INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS ISBN: 0-7803-0957-X</p> <p>page 232</p>	<p>1-8,10, 11,15</p>
X	<p style="text-align: center;">---</p> <p>GOOSSEN K W ET AL: "SILICON MODULATOR BASED ON MECHANICALLY-ACTIVE ANTI-REFLECTION LAYER WITH 1 MBIT/SEC CAPABILITY FOR FIBER-IN-THE-LOOP APPLICATIONS"</p> <p>IEEE PHOTONICS TECHNOLOGY LETTERS, vol. 6, no. 9, 1 September 1994 (1994-09-01), pages 1119-1121, XP000468079</p> <p>ISSN: 1041-1135</p> <p>the whole document</p>	<p>1-7, 9-11,15</p>
X	<p style="text-align: center;">---</p> <p>EP 0 667 548 A (AT & T CORP)</p> <p>16 August 1995 (1995-08-16)</p> <p>column 3, line 12 - line 35</p> <p>column 4, line 54 -column 6, line 30;</p> <p>figure 2</p> <p style="text-align: center;">-----</p>	<p>1-7, 9-11,15</p>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 99/07271

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-15,23,24

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

1. Claims: 1-15,23,24

An interferometric modulator comprising a cavity defined by two walls wherein the first wall is movable relative to the second wall and within the plane of the first wall

2. Claims: 16-18

Interferometric modulator comprising three walls and control circuitry for driving at least one of three walls

3. Claims: 19-20

an interference modulator comprising spacers mounted to form part of one of the walls

4. Claims: 21,22,25

Interference modulator comprising means to control the response time of the modulator

5. Claim : 26

Interferometric modulator comprising a charge deposition mitigating device

6. Claims: 27-32

An interferometric modulator, comprising walls and a support and at least one of the walls or the support comprising at least two materials

7. Claims: 33-38,44-48

A method of etching and patterning a microelectromechanical structure

8. Claims: 39-43

a method of making arrays of microelectromechanical structure on a production line

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/07271

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9530924 A	16-11-1995	US 5835255 A	10-11-1998
		EP 0801766 A	22-10-1997
		JP 10500224 T	06-01-1998

EP 0667548 A	16-08-1995	US 5500761 A	19-03-1996
		CA 2137063 A	28-07-1995
		US 5654819 A	05-08-1997
		US 5589974 A	31-12-1996

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